United States Department of Agriculture

FINAL STUDY REPORT
East Texas Plant Materials Center
Nacogdoches, Texas

Response of Harrison Germplasm Florida Paspalum to Seed Storage Environment, Storage Duration, and Prechilling

Melinda Brakie

ABSTRACT

Seed age and storage conditions affect seed dormancy in some warm season grass species. Florida paspalum (*Paspalum floridanum* Michx.) has shown varying degrees of seed dormancy in a source from Harrison County, Texas. Studies were conducted at the USDA-Natural Resources Conservation Service East Texas Plant Materials Center, Nacogdoches, Texas to determine the effect of cooler, room, and barn storage and prechilling treatments of 14 days at 38^0F on the germination of 2009 and 2010 seed lots of Harrison Germplasm Florida paspalum. Both seed lots exhibited minimal seed dormancy as exhibited by their limited response to prechill prior to germination testing. Storing seed in controlled conditions of a cooler ~ 50^0F and air conditioned room ~ 72^0F, prolonged seed viability compared to storage in a non-insulated, non-climate controlled barn. Storing seed in the uncontrolled conditions of the barn hastened breaking of dormancy, but after 18 to 24 months of storage, seed viability declined rapidly. Room storage increased length of seed viability when compared to barn storage in uncontrolled conditions. Cooler storage prolonged seed lot viability over the testing period when compared to room or barn storage. To preserve long term viability, seed lots should be stored in a cool (~50^0F) and low humidity (~50%) controlled environment.

INTRODUCTION

Florida paspalum is a native, warm season, perennial grass adapted to the southeastern United States. This grass prefers moist, well-drained soils, but will grow on dry sandy or poorly drained sites with neutral to acid soils (Grelen and Hughes, 1984 and Leithead and Yarlett, 1971). Florida paspalum is used for food and cover by game birds, especially quail, dove, and turkey (Grelen and Hughes, 1984).

Seed of Harrison Germplasm Florida paspalum (released in 2004 by the USDA-NRCS East Texas Plant Materials Center (ETPMC)) have exhibited various degrees of seed dormancy which can adversely affect stand establishment. Studies have shown seed germination and dormancy reduction of switchgrass are improved by using high storage temperatures, prolonged storage, and moist prechilling (Aho et al., 1989; Zarnstorff et al., 1994; Zhang and Maun, 1989).

Storing harvested seed in an uncontrolled environment of a barn or warehouse is a lower cost alternative to room or cooler storage. However, storage temperatures fluctuate from lower

Melinda Brakie is Soil Conservationist at the USDA-NRCS East Texas Plant Materials Center, Nacogdoches, TX 75964. Phone: (936) 564-4873; Fax: (844) 496-8039.

(night time) to higher (daytime) according to prevailing weather conditions. Bewley and Black (1994) note such fluctuations are generally effective at breaking dormancy in *Nicotiana tabacum* L. and *Rumex* species. The objective of this study was to determine the effect of storage environment, storage duration, and prechill treatment on germination of 2009 and 2010 harvested seed lots of Harrison Germplasm Florida paspalum.

MATERIALS AND METHODS

Cleaned seed samples of 2009 and 2010 Harrison Germplasm Florida paspalum harvests from the USDA-NRCS ETPMC were separated into heavy and light fractions using a South Dakota seed blower (Seedburo Equipment Co., Chicago, IL). The heavy fraction was divided into thirds and placed into paper envelopes for storage. The envelopes were assigned for the entire test period to one of three storage treatments: 1) Cooler - cooler with a controlled environment of ~ 50^0F and ~50% relative humidity; 2) Room temperature - Plant Materials Center seed lab at ~ 70^0F; 3) Barn - seed processing barn with temperatures ranging from ~ 31.7^0F to ~ 104.5^0F and ambient humidity levels. Pregermination seed treatments consisted of prechilling (PC) for 14 days at 38^0F prior to germination testing and no prechill (NP) (control) for each storage treatment.

The 2009 seed lots were tested for four years and the 2010 seed lots for three years. Germination tests were conducted every 3 months throughout the testing periods. Four replications of one hundred seeds were used for each storage/pretreatment combination. Seeds of each replication were placed between two layers of germination paper (Anchor Paper, St. Paul, MN) moistened with 2% KNO_3 solution in a clear plastic germination box with form fitting lid (Pioneer Plastics, Dixon, KY). The boxes were placed in a germinator (Hoffman Manufacturing Co., Albany, OR) for 28 days with alternating day/night temperatures of 85^0F/68^0F and 8 hr light/16 hr dark (Claxton, 2007). Seeds exhibiting both a root and shoot were counted and discarded at 7, 14, 21 and 28 days. Data for the total germination at 28 days was analyzed using multiple linear regression in Microsoft 2013 Excel® (Microsoft Corp., Redmond, WA).

RESULTS AND DISCUSSION

Many seeds require exposure to cold, moist conditions (prechilling) before germinating. During prechilling, seeds are kept moist at temperatures of 34 to 41^0F, mimicking winter conditions. This process enhances germination energy (how fast germination begins when the seeds are placed in favorable conditions) (Dumroese et al., 2012). Prechilling was used to determine if dormancy was present in the seed lots and if seed germination was influenced more by storage environment, duration or prechilling. There was a minimal increase in seed germination by the PC seed, indicating seed lots were influenced more by storage environments and duration.

Seed lots stored in the barn overcame dormancy between 6 and 9 months after harvest and by 18 months after harvest the NP treatment had reached ~40% and ~85% for 2009 and 2010, respectively (Fig 1. and Fig. 2). However, seed germination of the NP treatment of both harvest years began a steady decline after ~24 months of storage. This result is similar to a study by Coukos (1944) in which seeds of big bluestem (*Andropogon gerardii* Vitman), little bluestem [*Schizachyrium scoparium* (Michx.) Nash] and Indiangrass [*Sorghastrum nutans* (L.) Nash] stored in a barn loft did not begin average germination (>50%) until 14 to 18 months after harvest and retained good viability for only about 10 months. Kalmbacher (1999) also noted a

short storage time for 'Suerte' atra paspalum (*Paspalum atratum* Swallen) stored in a building in uncontrolled conditions. At 6 months of uncontrolled storage, he noted an increased germination of 69%. However, germination had decreased to zero after 1 year.

Benech-Arnold and Sanchez (2004) note among the many factors affecting seed deterioration, "relative humidity and temperature are the two most important." They continue to explain that relative humidity influences the moisture content of the stored seeds as they equalize with the surrounding gaseous water. Temperature determines the amount of moisture the air can hold (higher temperatures hold more water than lower temperatures) and aids the rate of seed deterioration as temperature increases. Seeds stored above 14 percent moisture have increased respiration, heating, and fungal invasion (Benech-Arnold and Sanchez, 2004). Seed lots stored in the barn were subjected to higher temperatures and possibly higher humidity in the late spring and summer than the cooler and room stored seed lots. Therefore, a possible explanation for the decline in germination of Harrison Germplasm Florida paspalum seed lots stored in the barn was quicker seed deterioration resulting from uncontrolled relative humidity and temperature levels.

Storing seed lots in the controlled conditions of room temperature (lab) prolonged seed viability when compared to barn storage. The 2009 seedlot overcame dormancy at ~15 months after harvest which was similar to Coukos' (1944) results for room storage of big bluestem and indiangrass seed lots. In contrast, the 2010 seed lot overcame dormancy within six months after harvest. In a 13 month study by Emal and Conard (1973), Indiangrass seed lots exhibited better germination after 7 months when stored under room conditions. The difference between the two seed lots is not unusual. Seed dormancy may vary from year to year for a given species (Laude, 1956). The 2009 NP seed lots maintained ~60% germination for 6 months (from 30 to 36 months after harvest) and then began to decline. The 2010 NP seed lots remained above 80% germination for 12 months (from 18 to 30 months after harvest) and also began to decline afterwards.

Seed lots stored in the cooler showed the highest percent germination of the three storage treatments at the end of testing. The 2009 seed lots exhibited seed dormancy until 45 months after storage and germination was ~60% three months later at the end of the testing period. The 2010 seed lots overcame dormancy earlier at 18 months of storage and the percent germination of the NP seed lots continued to increase throughout the testing period. Storing seed lots in the controlled conditions of the cooler prolonged seed viability when compared to barn storage. Coukos (1944) noted that dry cold storage extended the dormancy of little bluestem and indiangrass seed lots when compared to room or barn storage. This is due to a lower rate of respiration of the seed at cooler temperature (Bewley and Black, 1994).

CONCLUSION

Harrison Germplasm Florida paspalum seed has shown it can be stored short-term in an uncontrolled environment up to 18 to 24 months but viability decreases rapidly thereafter. Seed viability was prolonged by storing Harrison Germplasm Florida paspalum under dry, controlled conditions. For long term viability, seed should be stored in a cooler temperature (50) and low humidity (50%) controlled environment.

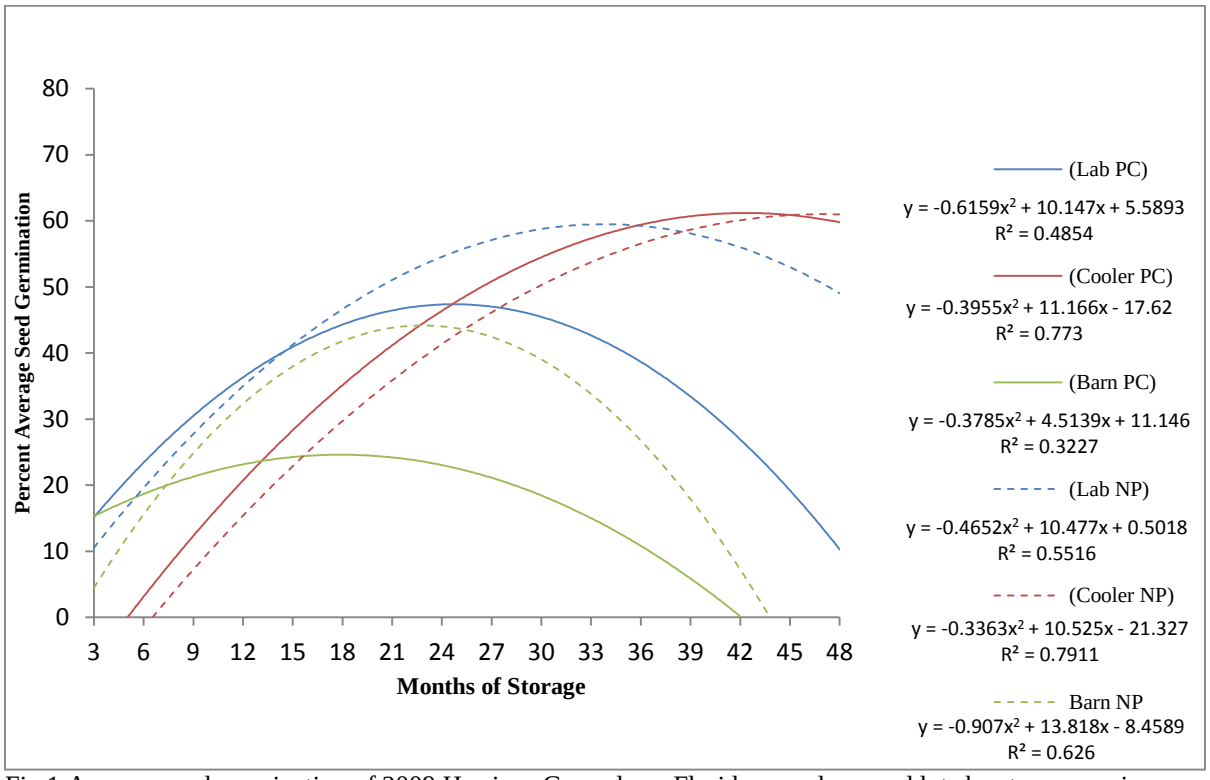

Fig.1 Average seed germination of 2009 Harrison Germplasm Florida paspalum seed lots by storage environment and seed treatment (Prechill-PC; No Prechill (NP). (2009-2013) USDA-NRCS East Texas Plant Materials Center, Nacogdoches, Texas.

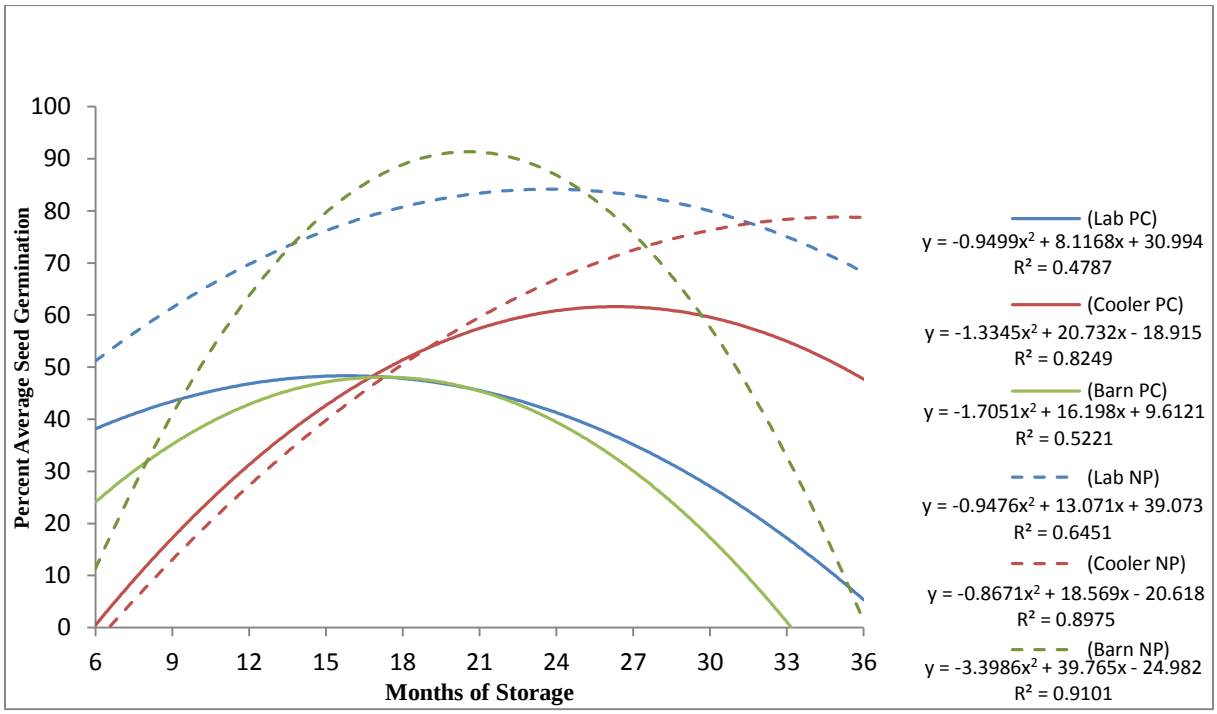

Fig.2 Average seed germination of 2010 Harrison Germplasm Florida paspalum seed lots by storage environment and seed treatment (Prechill-PC; No Prechill (NP). (2010-2013) USDA-NRCS East Texas Plant Materials Center, Nacogdoches, Texas.

LITERATURE CITED

Aho, D.W., D.J. Parrish, and D.D. Wolfe. 1989. Biological and management factors affecting switchgrass seed dormancy. In Agronomy Abstracts. ASA, Madison, WI.

Benech-Arnold, R.L. and R.A. Sanchez. (eds.) 2004. Handbook of seed physiology-applications to agriculture. Food Products Press. Binghamton, NY.

Bewley, J.D., and M. Black. 1994. Seeds-physiology of development and germination. 2nd ed. Plenum Press. New York, NY.

Claxton, J. 2007. Testing procedure for Florida paspalum. Giddings Seed Testing Laboratory, Texas Dept. of Agriculture. Unpublished correspondence.

Coukos, C.J. 1944. Seed dormancy and germination in some native grasses. Agron. J. (36) p. 337-345.

Dumroese, R.K., T.D. Landis, and T. Luna. 2012. Raising native plants in nurseries: basic concepts. Gen. Tech. Rep. RMRS-GTR-274. USDA-Forest Service Rocky Mtn. Res. Stn, Ft. Collins, CO.

Emal, J.G. and Conard, E.C. 1973. Seed dormancy and germination in indiangrass as affected by light, chilling, and certain chemical treatments. Agron. J. (65) p. 383-385.

Grelen, H.E. and R.H. Hughes. 1984. Common herbaceous plants of southern forest range. Res. paper SO-210. USDA- Forest Service Southern Forest Exp. Stn, New Orleans, LA.

Kalmbacher, R.S., S.H. West and F.G. Martin. 1999. Seed dormancy and aging in atra paspalum. Crop Sci. (39) p. 1847-1852.

Laude, H.M. 1956. Germination of freshly harvested seed of some western range species. J. Range Mgt. (9) p.126-129.

Leithead, H. L., L.L. Yarlett, and T.N. Shiflet. 1971. 100 native grasses in 11 southern states. Ag. Handbook No. 389. USDA- SCS Washington, D.C.

Zarnstorff, M.E., R.D. Keys, and D.S. Chamblee. 1994. Growth regulator and seed storage effects on switchgrass germination. Agron. J. (86) p. 667-672.

Zhang, J. and M.A. Maun. 1989. Seed dormancy of Panicum virgatum L. on the shoreline sand dunes of Lake Erie. Am. Midl. Nat. (122) p. 77-87.